An outlook on current recording and breeding programs of the Holstein cattle in Brazil[1]

Embrapa Gado de Leite

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Introduction

Brazilian milk production increased 70% between 1990 and 2005, when it reached 24.6 billion litters and ranked seventh in world production. The Brazilian dairy population in 2005 comprised some 20,6 million cows and average milk production of the dairy and dual purpose systems was about 1200 kg/cow. Brazil's dairy cattle management systems are highly variable. Production systems range from input-intensive operations utilizing specialized dairy breeds to low input, land-extensive dual purpose systems using crosses between European and zebu breeds.

Brazilian dairy industry has made improvements lately. Trading balance of dairy products in the international market was positive for the first time in 2004 (Figure 1). About 1.5 % of the national milk production was exported and the trading balance reached US$ 9 millions in 2005 (CARVALHO and OLIVEIRA, 2006).

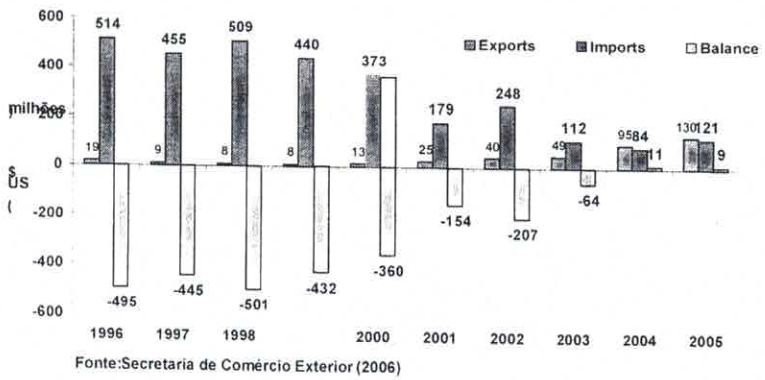

Figure 1 - Values of imports, exports and balance of Brazilian dairy products.

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There is a consensus about the importance of improving milk quality in Brazil. New regulations and directives on milk quality standards (BRASIL, 2002a) are stimulating the dairy farmer to collect records in milk quality and hygiene to get better prices for their milk in the market. Milk testing laboratories started their operations after mid 90's and in 2002 Ministry of Agriculture, Livestock and Supply (MAPA) set up the Brazilian Laboratory Network comprising nine laboratories involved in analyses of milk components, somatic cell and bacterial count from dairy farms (BRASIL, 2002b). Animal identification and recording was introduced by government regulations primarily for the beef industry and official agencies are enhancing the implementation of programs for traceability and food safety.

Milk recording, phenotypic and structural trends

The Holstein is the most important European dairy breed in Brazil. Breeders are traditional customers of imported semen, which is about 80% of total sales in the domestic market for dairy breeds (Figure 2). However, there is no breeding program designed to take advantage of semen imports from countries with competitive and superior genetics to improve the Holstein breed under Brazilian production systems. Local climate, market, management and feeding conditions strongly differ from those observed in countries exporting top dairy cattle genetics.

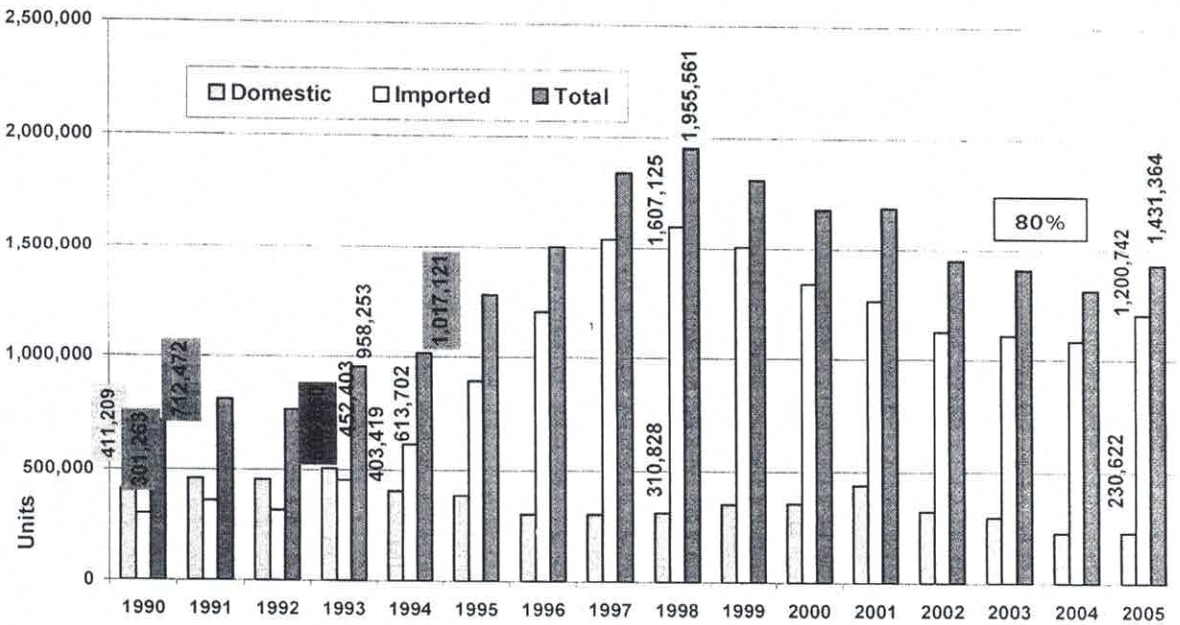

Figure 2 - Sales of domestic, imported and total semen of the Holstein breed in Brazil from 1990/2005. (Source: Compiled by authors from ASBIA Annual Reports).

The Brazilian Holstein Association (ABCBRH) was founded in 1934. It is involved in maintaining the herd-book, registration and linear type classification (conformation score) of animals, milk recording and breed publicity. Animals are voluntarily pedigree and performance recorded and the recording scheme is practically inflexible and monthly recording has been the official method of milk recording.

In 2002 ABCBRH and its state affiliates provided data to Embrapa Gado de Leite to evaluate milk recording structure and performance trends for production traits. From 1981 to

2001 about 1789 herds used milk recording (MR) services. During this period the number of breeders and Holstein cows enrolled in MR services increased substantially till 1994 when reached 747 herds and 36.544 cows. After, there was a steady decrease, 35,6% and 18% in number of herds and cows, respectively. One in three dairy herds cancelled MR services, with roughly 4.6% (36 herds) decrease per year. Figure 3 shows the trends in average milk yield/lactation, number of herds and lactations/herd as a proxy for herd size. From 1981 to 2001 305-d milk yield increased 46,7 percent and reached 7.254 kg/lactation, a phenotypic ~ 4% annual positive trend. This increase was achieved with a concurrent 154 percent increase in number of cows/herd. Averages for fat and protein yields in 2001 were respectively 238.8 and 228.3 kg/lactation.

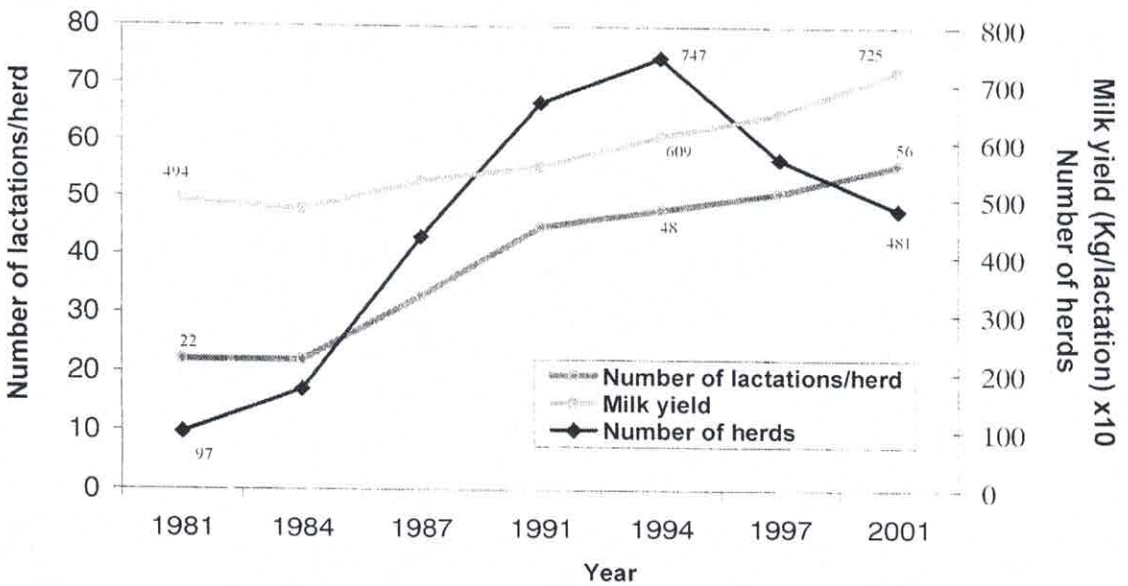

Figure 3 - Milk yield/lactation, number and size of herds of the Holstein breed in milk recording in Brazil from 1981 to 2001 (COSTA et al., 2005a).

Figures from recent report for the year 2006 indicate 1663 active members in ABCBRH. A total of 37554 animals were registered in the herd-book (a decrease of 51.4% over 1997); less than 7000 cows were classified and 31505 cows were milk recorded in 486 herds. Average ME 305-days milk yield was 9026 kg/lactation. Overall they reflect the structural changes that have been observed in dairy farming in Brazil towards specialization, which is imposed by a globalized economy scenario.

Breeding strategies in Brazil

Genetic evaluation is a key factor to produce improved animals. An effort was initiated at Embrapa Gado de Leite to design and maintain a national dairy database and computer programs for editing lactation and pedigree records, calculating genetic evaluation and preparing reports for industry distribution.

Genetic evaluations for dairy breeds in Brazil started in mid 80s, but were interrupted in 1995, after Ministry of Agriculture stopped providing financial support to breeders

associations. Genetic evaluations restarted in 2003 and breeding values for milk and fat yields were released in Sire Summaries. Breeding values for protein yield and conformation traits were also released for the first time in 2004. In 2006, 1990 sires were evaluated for milk, 1983 for fat and 1016 for protein yield (Table1). Average milk, fat and protein yields of first lactation cows calving at 28.5 months of age were 6210.0, 204.6 and 211.8 kg, respectively. In this same order, heritability values were 0.25, 022 and 0.22 (COSTA et al., 2006).

Table 1 - Average and standard deviation, heritability, number of animals and herds in databases used for genetic evaluations of yield traits of Holstein cattle in Brazil in 2006.

Yield	Mean ± SD (kg)	Heritability	Animals / herds		
			Bulls	Cows	Herds
Milk	6210.0 ± 1728.0	0.25	1990	104138	1889
Fat	204.6 ± 59.1	0.22	1983	103538	1883
Protein	211.8 ± 49.0	0.22	1016	43572	770

Genetic information related to 21 type traits and final score of Holstein cattle in Brazil is displayed on Table 2. The Linear scoring of conformation followed the Canadian system which evaluates traits in a 1-9 point scale.

Table 2 - Average, standard deviation (SD), additive genetic and residual variances estimates, heritability and respective standard errors (SE) of type traits and final conformation of Holstein cows.

Type trait	*Average ± SD*	*Genetic*	*Residual*	*Heritability ± SE*
Frame / Capacity				
Stature	7.1 ± 1.4	0.585	0.867	0.40 ± 0.02
Height at front end	5.4 ± 1.1	0.131	0.627	0.17 ± 0.02
Weight	6.7 ± 1.4	0.366	0.839	0.30 ± 0.02
Chest width	5.8 ± 1.3	0.180	0.986	0.15 ± 0.02
Body depth	6.3 ± 1.0	0.171	0.603	0.22 ± 0.02
Loin strength	6.5 ± 1.3	0.287	0.998	0.22 ± 0.02
Rump				
Rump angle	5,0 ± 0,9	0.221	0.601	0.27 ± 0.02
Rump width	6.6 ± 1.3	0.371	0.777	0.32 ± 0.02
Feet & Legs				
Foot angle	5.2 ± 1.3	0.122	1.027	0.11 ± 0.01
Bone quality	6.3 ± 1.3	0.243	1.110	0.18 ± 0.02
Rear legs side view	5.6 ± 1.1	0.230	0.903	0.20 ± 0.02
Fore Udder				
Fore udder	5.8 ± 1.5	0.318	1.606	0.17 ± 0.02
Teat placement	4.3 ± 1.1	0.276	0.878	0.24 ± 0.02
Teat length	5.2 ± 1.0	0.386	0.638	0.38 ± 0.02
Rear Udder				
Udder height	6.4 ± 1.2	0.226	0.903	0.20 ± 0.02
Udder width	5.7 ± 1.5	0.244	1.207	0.17 ± 0.02
Teat placement	6.3 ± 1.2	0.217	0.952	0.19 ± 0.02

Overall Udder				
Udder Depth	4.9 ± 1.2	0.231	0.822	0.22 ± 0.02
Texture	6.5 ± 1.2	0.089	0.935	0.09 ± 0.01
Udder support	6.3 ± 1.4	0.350	1.284	0.21 ± 0.02
Dairy character				
Angularity	6.5 ± 1.2	0.197	0.718	0.22 ± 0.02
Final Score	81.1 ± 3.4	1.188	5.045	0.19 ± 0.02

Variance components were estimated by single trait analyses using classification records of 21208 cows, progeny of 842 sires. Heritability estimates were generally moderate. Estimates were lower for udder texture (0.09), foot angle (0.11) and chest width (0.15) and larger for stature (0.40), teat length (0.38) and rump width (0.32). Heritability estimates were in agreement with those used by countries participating in Interbull (INTERBULL, 1996). In 2006, genetic evaluations for type traits used records of 30658 cows, progeny of 1071 bulls.

Genetic progress

Traditionally Brazilian Holstein breeders are users of semen imported from North America and Europe. Choice of semen is generally based on sire proofs from the exporting countries. Estimates of genetic gain indicate effectiveness of imports to promote genetic progress locally. Genetic trends for milk, fat and protein for sires and cows were estimated by regression of the Predicted Transmitting Ability (PTA) on birth year (COSTA et al., 2005b). Estimated weighted average annual genetic gains (kg/year) were 13.8 for milk (Figure 4), 0.32 for fat, respectively, for sires born from 1968 to 1996 and 0.39 for protein for sires born from 1976 to 1995. Genetic gains were 8.3 for milk and 0.26 for fat for cows born from 1981 to 2000 and 0.29 for protein for cows born from 1989 to 2000. Annual weighted genetic gains for sires were 0.23, 0.16 and 0.18 % of the average population for milk, fat and protein yields, respectively. Genetic gains in the last ten-year period were lower than those from earlier periods suggesting the population has progressed at a decreasing pace.

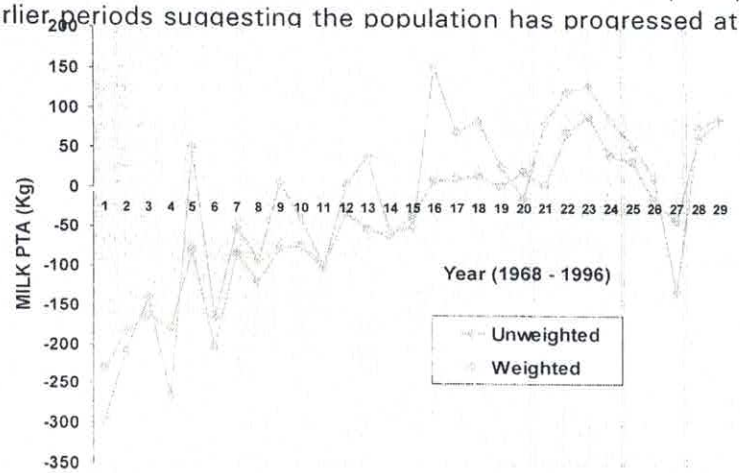

Figure 4 - Genetic trends for milk yield estimated by unweighted and weighted (on number of daughters) PTAs of sires regressed on birth year of progeny.

These rates of genetic progress suggest that breeders have not been making the best decision when selecting sires for mating cows in their herds and probably have been considering traits other than production when selecting sires for breeding. Also, these rates of genetic progress may suggest genotype by environment (G*E) interaction (Table 3). Results from the study by COSTA (1998) indicated that there was little evidence of G*E interaction between the United States (US) and Brazilian high HYSD herds for milk and fat yields. However, estimates of the genetic correlation between the US and low HYSD herds was lower (0.79) for milk yield and similar (0.89) for fat yield, indicating that there may be some evidence of re-ranking between the US and low HYSD herds in Brazil. Overall, these results also indicate that semen imports without a breeding program are not contributing to genetically improve the performance of the Holstein cattle population in Brazil.

Table 3 – Genetic (sire) and residual variances, genetic covariances (cov), heritability (h^2) and genetic correlation (r_G) estimates from bivariate analyses for milk yield of Holstein cows between United States (US) and Brazil (BR).

Herd environment			Milk yield (kg)					
Herd	Environment[1]	Mean (kg)	Mean (kg)	σ^2_s (10^3)	σ^2_e (10^3)	h^2	Cov (10^3)	r_G
BR	L	1004	6432	72.6	900.5	.30	80.7	.79
	H	1319	7278	85.6	1,580.3	.20	96.7	.87
	ALL	1180	6877	87.6	1,263.4	.26	97.2	.85
US	ALL	1321	9022	148.2	1,562.0	.35		

[1]L = Low HYSD-MY <1120 kg; H = High HYSD-MY >1150 kg; All = all country data (COSTA, 1998).
HYSD-MY = Herd-year standard deviation of milk yield.

Final considerations

Genetic investments have been made by Brazilian breeders through semen imports. Brazil has the basic infrastructure to run a breeding program: milking recording organized by breeders associations and a strong AI industry. A small scale AI sampling program of young bulls for progeny test was started in 2004. Young bulls are selected by a committee formed by representatives of breeders and artificial insemination centers. ABCBRH is interested in expanding the progeny test through partnership with AI companies to optimize progress for genetic merit of Holstein breed in Brazil through better usage and diffusion of top imported sires. ABCBRH also envisages joining ICAR/Interbull in the medium term to provide genetic evaluations of international sires to Brazilian dairy farmers.

Developing a national selection program for the Holstein breed in Brazil is an issue related to the modernization of the Brazilian dairy productive chain. The genetic evaluation program has been technically supported by research carried out at Embrapa Gado de Leite and universities. They are committed to maintaining their research program to provide knowledge on new methodologies and advances in computing, statistics as well as in molecular genetics as far as good data are made available from ABCBRH and its affiliates. Studies on methods to provide genetic evaluations for somatic cell count, longevity, persistency and indices for genetic merit have been planned. Research on random regression models to use test-day

models are in progress. Genotype and environment interaction and heat stress are other subjects under consideration. Strong international cooperation among Embrapa Gado de Leite and research institutions, breed associations and universities from North America and Europe has been very productive. All these issues and the expansion of the breeding program must be considered as opportunities for technical and scientific cooperation among breeding societies, milk recording services, AI companies and research and university centers from Latin America countries.

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IX Congreso Holstein de las Américas
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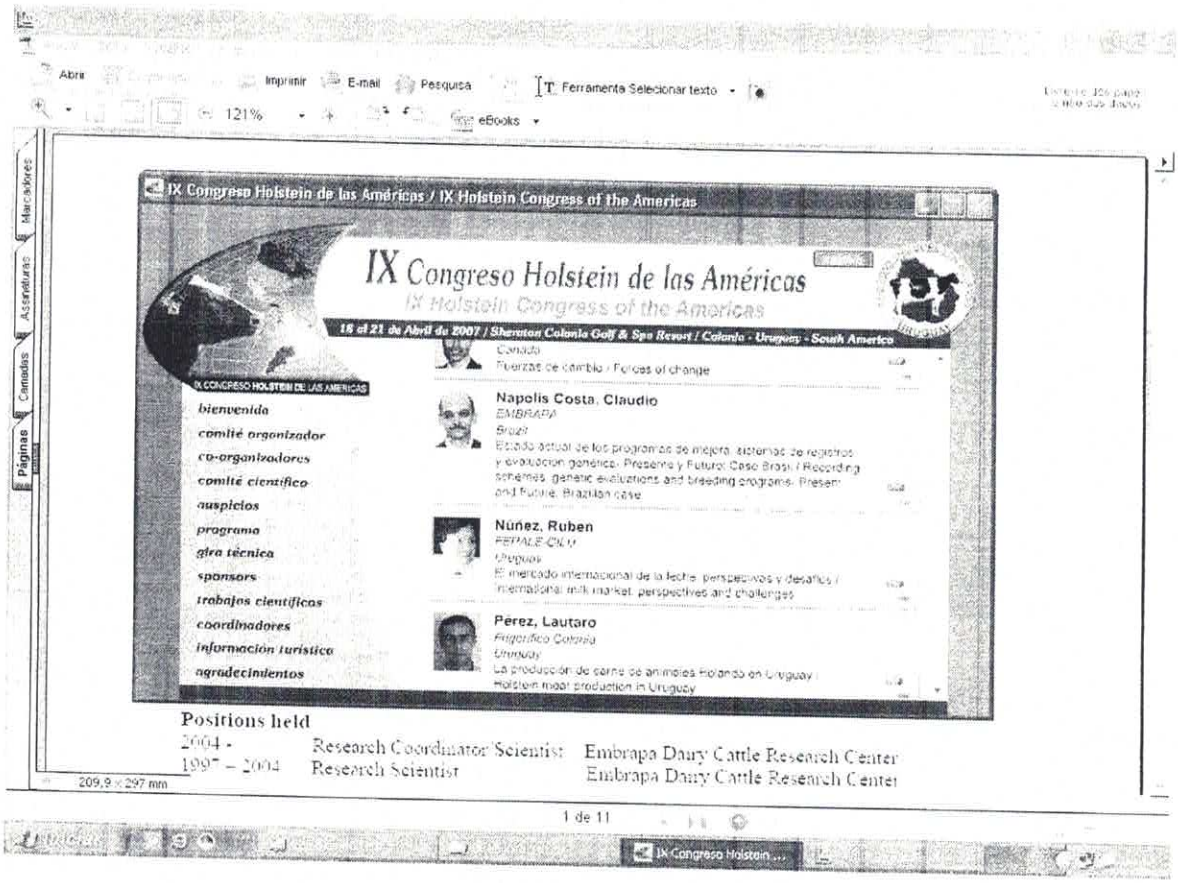

Positions held

2004 - Research Coordinator/Scientist Embrapa Dairy Cattle Research Center

1997 – 2004 Research Scientist Embrapa Dairy Cattle Research Center

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1998 Ph.D. (Animal Breeding), Cornell University, Ithaca – NY, USA.
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2004 -	Research Coordinator/Scientist	Embrapa Dairy Cattle Research Center
1997 – 2004	Research Scientist	Embrapa Dairy Cattle Research Center
1992 – 1997	PhD Graduate Program	Cornell University
1990 - 1992	Administrative Director	Embrapa Dairy Cattle Research Center
1987 - 1989	Research Scientist	Embrapa Dairy Cattle Research Center
1985 - 1987	General Director	Embrapa Swine & Poultry Research Center
1981 - 1984	Research Scientist	Embrapa Swine & Poultry Research Center

Research areas

Animal breeding
Genetic evaluation
Statistical genetics
Computing in Animal Breeding

Countries of recent visits or talks

FAO/ICAR meeting in Interlaken, Switzerland in 2002; FAO/ICAR meeting in Sousse, Tunisia in 2004; University of Porto/ICBAS in Porto, Portugal in 2004; Interbull Center and EAAP meeting at Uppsalla, Sweden in 2005.

Research & Development activities

General coordinator of R&D projects on dairy cattle breeding and database development. Design of research projects on dairy cattle breeding: statistical models, genetic evaluations, selection programs in cooperation with breeding societies of dairy cattle and artificial insemination companies.
Consultancy and participation on Advisory Technical Commitees of Breeding Societies. Design of technology transfer and extension programs on dairy cattle management in cooperation with dairy cooperatives and industries.
Organization of databases on performance and economic records to provide advisory services to dairy farmers using information technology.
Evaluation of research and development programs/projects for dairy production development.
Participation in work groups aimed at stratategic planning: institutional framework and R&D management.
Colaboration with universities graduate programs as a member of advisory committees.

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(Texto informado pelo autor)

Estado atual dos programas de registro e melhoria genética da raça Holandesa no Brasil

Cláudio Nápolis Costa[1]

A produção de leite no Brasil tem aumentado contínuamente desde a década de 70, alcançando 24,6 bilhões de litros em 2005. Apesar do aumento da produção, a produtividade do rebanho nacional é muito baixa, ao redor de 1200 kg/vaca/ano. A indústria leiteira tem se fortalecido e, em 2004, foi obtido, mesmo que modesto, o primeiro superávit na balança comercial de lácteos. Há um consenso sobre a importância da melhoria da qualidade, com estímulos para maior conteúdo de sólidos e menor contagem de células somáticas (CCS) no leite e dos processos de rastreabilidade e da segurança alimentar.

A raça Holandesa é a mais difundida no Brasil e seus criadores são usuários de sêmen importado. Oportunidade estratégica para aumento da produtividade, todavia não é ainda considerada, pois não há um programa de seleção delineado para a melhoria da raça no Brasil.

Em 2002, a Associação Brasileira de Criadores de Bovinos da Raça Holandesa - ABCBRH e suas filiadas estaduais, com o apoio técnico da Embrapa Gado de Leite, iniciaram estudos para estruturar um programa de seleção para a raça. Constatou-se que, no período de 1981 a 2001, 1789 rebanhos participaram do Controle Leiteiro das Associações filiadas. O número de rebanhos e de vacas controlados aumentou até o ano de 1994, mas reduziu desde então e em 2001 haviam 481 rebanhos participando do controle leiteiro. Neste período, a produção em 305 dias de lactação aumentou 46,7%, aproximadamente 4,0% ao ano, alcançando 7.254 kg, e o número de vacas em controle por rebanho cresceu para 56, uma evolução de 154%.

Interrompidas ao final da década de 90, as avaliações genéticas nacionais para as características produtivas (leite e gordura) foram reiniciadas em 2003. Os resultados têm sido apresentados anualmente, em Sumários de Touros, os quais são classificados pelo valor genético. Em 2004, além das produçoes de leite e de gordura, foram realizadas pela primeira vez no Brasil as avaliações genéticas para a produção de proteína e para as características de tipo. Em 2006 foram avaliados 1016 touros para a produção de proteína, 1983 para as produções de leite e gordura e 1071 para tipo. As produções de leite, gordura e proteína na primeira lactação, em media aos 28,5 meses, foram 6210,0; 204,6 e 211,8 kg. As heritabilidades para as produções de leite, gordura e proteína foram,

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respectivamente, 0,25, 0,22 e 0,22. Para as características de tipo as heritabilidades foram moderadas, menores para textura do úbere e ângulo do casco (0,09) e largura do úbere posterior (0,17) e maiores para estatura (0,43), comprimento de tetas anteriores (0,37) e largura de garupa (0,34).

Em 2004, foram estimados os ganhos genéticos para as produções de leite, gordura e proteína nos períodos de 1968/1996 em touros e de 1981/2000 em vacas. As taxas de progresso genético anual foram muito baixas e corresponderamm a menos de 0,2% da média da respectiva característica. Tais resultados podem ser o reflexo da interação genótipo x ambiente, mas é muito provável que os produtores não estejam escolhendo os melhores touros disponíveis para acasalamento. No seu conjunto, os resultados indicam que as importações, sem um programa de seleção, não têm contribuído efetivamente para a melhoria genética da raça Holandesa no Brasil.

Em 2003 foi iniciado, em pequena escala, o teste de progênie de touros jovens da raça, pré-selecionados pelo *pedigree*, com participação de associações estaduais de criadores e da indústria de sêmen. A implementação do teste de progênie para a disponibilização de touros provados, para otimizar os investimentos na melhoria da produtividade e o nível genético da raça Holandesa no Brasil é um desafio. A ABCBRH tem interesse em delinear e extender o programa de seleção e se filiar ao Interbull. Pesquisas para implementar as avaliações genéticas para CCS, persistência, longevidade e índices de mérito produtivo, bem como o uso do test day model com os polinômios de Legendre estão em curso de realização. A interação genótipo e ambiente e stress calórico são outros temas também estudados. Estes temas e a ampliação do programa de seleção poderiam ser fatores motivadores para uma interação técnico-científica entre associações de criadores, serviços de controle leiteiro e instituições de ensino e de pesquisa dos Países da América do Sul.